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The EFP-94 Project on Safety Systems for Wind Turbines

Method for Evaluation of Failure Modes and Reliability

Appendix 3

Database Objects

Risø National Laboratory, Roskilde, Denmark
September 1996

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Risø National Laboratory, Roskilde, Denmark
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Abstract The database objects, which are summarised in the main report of the project are described in detail.

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Contents

1. Introduction

The present publication contains details about certain parts of the database, the so-called database objects, referred to in [1].

2. Database objects

The PC database has six types of objects: tables, queries, forms, reports, macros and modules. They are briefly described below.

2.1. Tables

The tables are Microsoft Access objects that in our case store reliability and reliability related information. The whole list of the tables is the following:

Tables	Explanation
Main tables FMECA table 150 Main table 150 Components 150 Initiating events 150 WTB 150	The contents of the five main tables is described above in section "Logical data model"
Subsidiary tables Basic events for 5001 Basic events for 5002 Basic events for 5003 Basic events for 5004 Basic events for 5005 Basic events for 5006 Basic events for 5007 Basic events for 5008 Basic events for 5010 Basic events for 5011	Tables contain the lists of basic events for each of the top events written in the name of the table. So numbers from 5001 to 5011 correspond to the top events in the Cause-Consequence Diagram
Failure causes	The list of possible failure causes
Failure modes	The list of possible failure modes
Failure rates data	Failure rates are periodically updated by the user on the basis of failure data from the database and saved in this table

Tables	Explanation
Failure rates structure Failure rates tmp	Were created to achieve programmer's objectives. The tables are out of the user's interest
How detected	The list of possible ways of the detection of failed component
Responsibility	The list of possible responsible departments
Severity	The list of possible severity grades
Systems	The list of all WTB systems
Top event	Out of user's interest
Types of manufactory's WTB	The list of WTB types included in the database

2.2. Queries

With a query we ask a question about the data stored in the tables. The way we design a query tells Microsoft Access exactly which data to retrieve. Queries in the current database are used to extract desired data, that afterwards are presented in the reports.

The whole list of the queries created is the following:

Queries	Brief explanation
Append IE to Failure Rates Data Failure Rates 1 Failure Rates 2 Failure Rates 3 Failure Rates 4 Failure Rates Query Failure Rates Query Old Final Failure Rate Data	Queries are necessary for extracting failure data for each of the basic events, calculating failure rates according to formula (2), creating the table Failure Rates Data to store the data, appending initiating event frequencies to the table.
Component Query 1 Component Query 2	Select data at the *component level* for two types of the reports depending on an option chosen
System Query	Select data at the *system level* for the report
WTB Query	Select data at the *level "WTB as a whole"* for the report

Queries	Brief explanation
System-Component for Main Table System-Component for FMECA	Queries used for providing relationship "*Specific system → list of components for that system*". Two of the tables have their own query.
Top Event 5001-1 Top Event 5001-2 Top Event 5002-1 Top Event 5002-2 Top Event 5003-1 Top Event 5003-2 Top Event 5004-1 Top Event 5004-2 Top Event 5005-1 Top Event 5005-2 Top Event 5006-1 Top Event 5006-2 Top Event 5007-1 Top Event 5007-2 Top Event 5008-1 Top Event 5008-1 Top Event 5010-1 Top Event 5010-2 Top Event 5011-1 Top Event 5011-2	Queries "*Top Event XXXX-1*" select information about the basic events leading to the top event XXXX. These queries are *Record Source* for the form "*Top Event 1*". Queries "*Top Event XXXX-2*" select failure data concerning the basic events leading to the top event XXXX. These queries are *Record Source* for the form "*Top Event 2*".

2.3. Forms

A form provides an easy way to view data. We can view all the values for one record in Form view, or we can switch to the Datasheet view of the form to see all records for that form. Using a form is also an efficient way to enter data; it can save time and prevent typing errors. For example, rather than type values for all fields, we can create lists in the form from which you choose values. A form offers the most convenient layout for entering, changing, and viewing records in the database.

16 different forms were created that together with the reports constitute the user's interface. Using the forms is easy since they are of the same concept as much other Microsoft software. Unlike the other Access objects a description is not necessary in this report since they can be understood during the use of the database.

2.4. Reports

Creating a report is an efficient means of presenting a printed document since it offers great flexibility in presenting summary information. There are a number of reports in the database:

Report	Explanation
Component Smallest	The report is a result of the chain of choices at the component level "*Specific WTB- Specific Component*"
Component Small	The report is a result of the chain of choices at the component level "*Specific WTB- All Components*"
Component	The report is as a result of the chain of choices at the component level "*All WTBs - All Components*"
System Small	The report is as a result of choice at the system level "*Specific WTB*"
System	The report is a result of choice at the system level "*All WTBs*"
WTB Small	The report is a result of choice "*Specific WTB*" at the level "WTB as a whole"
WTB	The report is a result of choice "*All WTBs*" at the level "WTB as a whole"

2.5. Macros

Using macros we can make forms, reports, and other database objects work together more intelligently. A macro automatically carries out a task or a series of tasks for the user. Each task that we want Microsoft Access to perform is called an action. When we run the macro, Access carries out the action in the sequence they are listed, using the objects or data we have specified.

The whole list of macros is the following:

Macro	Action	Action arguments
Autoexec	OpenForm	Form1
	RunCode	Calculate_days ()
Buttom of view invisible	SetValue	Item: [Forms]![Calculations]![Button18].[Visible]
		Exp.: =No

Macro	Action	Action arguments
Close Component Query 1	Close	Query: Component Query 1
Close Component Query 2	Close	Query: Component Query 2
Close System Query	Close	Query: System Query
Close WTB Query	Close	Query: WTB Query
Connect Comp Report with Table	Echo	Echo On: No Text: Just a moment
	SetValue	Item: [Forms]![Component Menu]![Field42] Exp: [Reports]![Component].[RecordSource]
Connect Components with the Form The macro sets RecordSource property of the form Components to the value the Combo box Field21. That is, one chooses a type of WTB from the Combo box 'Field21' and then a corresponding table becomes visible under the Form.	SetValue	Item: [Forms]![Components].[RecordSource] Exp.: [Forms]![Components]![Field21]
	SetValue	Item: [Forms]![Components]![Section](0).[Visible] Exp.: =Yes
	OpenForm	Form: Components
Connect FMECA Table with the Form	SetValue	Item: [Forms]![FMECA Table].[RecordSource] Exp.: [Forms]![FMECA Table]![Field66]
	SetValue	Item: [Forms]![FMECA Table]![Section](0).[Visible] Exp.: =Yes
	OpenForm	Form: FMECA Table
Connect IE with the Form	SetValue	Item: [Forms]![Initiating Events].[RecordSource] Exp.: [Forms]![Initiating Events]![Field19]
	SetValue	Item: [Forms]![Init. Events]![Section](0).[Visible] Exp.: =Yes
	OpenForm	Form: Initiating Events
Connect Main Table with the Form	SetValue	Item: [Forms]![Main Table].[RecordSource] Exp.: [Forms]![Main Table]![Field87]
	SetValue	Item: [Forms]![Main Table]![Section](0).[Visible] Exp.: =Yes
	OpenForm	Form: Main Table
Connect Sys Report with the Table	Echo	Echo On: No Text: Just a moment
	SetValue	Item:[Reports]![System].[RecordSource] Exp: [Forms]![System]![Field42]
Connect WTB with the Form	SetValue	Item: [Forms]![WTB].[RecordSource] Exp.: [Forms]![WTB]![Field17]
	SetValue	Item: [Forms]![WTB]![Section](0).[Visible] Exp.: =Yes
	OpenForm	Form: WTB
Copy Failure Rate Structure	CopyObject	New Name: Failure Rates Source Object Type: Table Source Object Name: Failure Rates Structure
Export Top Events	OutputTo	Object Type: Table Object Name: Top event Output Format: MS-DOS Text (*.txt) Output File: c:\EFP_94\Top_even.txt
Find number of stops	Echo	Echo On: Yes

Macro	Action	Action arguments
	FindRecord	Find What: 30<=[Date of calculation]-Date() Where: Start of Field Direction: Down Search In: Current Field Find First: Yes
	Beep	
Form 0 to Form 1	Echo	Echo On: No
	Close	Form: Form 0
	OpenForm	Form: Form 1
Form to Cause-Cons diagram	Echo	Echo On: No
	Close	
	OpenForm	Form: Cause-Consequence Diagram
Form to Form1	Echo	Echo On: No
	Close	
	OpenForm	Form: Form1
Form1 to Components	OpenForm	Form: Components
	Close	Form: Form1
Form1 to FMECA	OpenForm	Form: FMECA
	Close	Form: Form1
Form1 to Initiating Events	OpenForm	Form: Initiating Events
	Close	Form: Form1
Form1 to Main Table	OpenForm	Form: Main Table
	Close	Form: Form1
Form1 to Unwanted Events	Echo	Echo On: No
	OpenForm	Form: Unwanted Events
	Close	Form: Form 1
	RunCode	Function Name: Updat_rate()
Form1 to WTB	OpenForm	Form: WTB
	Close	Form: Form1
Open Component Query 1	Echo	Echo On: No
	OpenQuery	Query: Component Query 1
	OpenReport	Report: Component Small
Open Component Query 2	Echo	Echo On: No
	OpenQuery	Query: Component Query 2
	OpenReport	Report: Component Smallest
Open Component Report	Echo	Echo On: No
	OpenReport	Report: Component
Open Failure Rates Query	OpenQuery	Query: Failure Rates Query
Open System Query	Echo	Echo On: No
	OpenQuery	Query: System Query
	OpenReport	Report: System Small
Open System Report	Echo	Echo On: No
	OpenReport	Report: System
Open WTB Query	Echo	Echo On: No

Macro	Action	Action arguments
Open WTB Report	OpenQuery	Query: WTB Query
	OpenReport	Report: WTB Small
	Echo	Echo On: No
	OpenReport	Report: WTB
Previous - Next record	GoToRecord	Form: Main Table Record: Previous
	GoToRecord	Form: Main Table Record: Previous
	GoToRecord	Form: Main Table Record: Next
	GoToRecord	Form: Main Table Record: Next
	SetValue	Item: [Forms]![Main Table]![Basic event number] Exp.: [Forms]![Main Table]![FMECA]
Requery for FMECA	Requery	Control Name: Field87
Requery for Main	Requery	Control Name: Comp
Run Calculations 1	Echo	Echo On: No
	OutputTo	Object Type: Table Object Name: Top event Output Format: MS-DOS Text (*.txt) Output File: c:\EFP_94\Top_even.txt
	RunCode	Function: WaitShell("c:\EFP_94\binput.exe")
	RunCode	Function: WaitShell ("c:\EFP_94\bikhk.exe")
	RunCode	Function: WaitShell ("c:\EFP_94\dima.exe")
	RunCode	Function: WaitShell ("c:\EFP_94\cutin2.bat")
	RunCode	Function:WaitShell ("c:\EFP_94\cut_ev.bat")
	RunCode	Funct:WaitShell ("c:\EFP_94\bcut_imp.exe")
	SetValue	Item: [Forms]![Calculat]![Button18].[Visible] Expr.: =Yes
Run Calculations 2	Echo	Echo On: No
	OutputTo	Object Type: Table Object Name: Top event Output Format: MS-DOS Text (*.txt) Output File: c:\EFP_94\Top_even.txt
	RunCode	Function: WaitShell("c:\EFP_94\binput.exe")
	RunCode	Funct: WaitShell ("c:\EFP_94\bikhkub.exe")
	RunCode	Function: WaitShell ("c:\EFP_94\dima.exe")
	RunCode	Function: WaitShell ("c:\EFP_94\cutin2.bat")
	RunCode	Function:WaitShell ("c:\EFP_94\cut_ev.bat")
	RunCode	Funct:WaitShell ("c:\EFP_94\bcut_imp.exe")
	SetValue	Item: [Forms]![Calculat]![Button18].[Visible] Expr.: =Yes
Section(0) of Componets invisible This macro sets Visible property of the Section(0) of the form Components to 'No' and one cannot see any data on the form if WTB type is not chosen	SetValue	Item: [Forms]![components].[Section](0).[Visible] Exp.: = No
	MoveSize	Width: 20 cm
Section(0) of Comp Menu invisible	SetValue	Item: [Forms]![Comp. Menu].[Section](0).[Visible] Exp.: = No

Macro	Action	Action arguments
Section(0) of Comp Menu visible	SetValue	Item: [Forms]![Comp. Menu].[Section](0).[Visible] Exp.: = Yes
Section(0) of FMECA invisible	SetValue	Item: [Forms]![FMECA].[Section](0).[Visible] Exp.: = No
	MoveSize	Width: 19 cm
Section(0) of IE invisible	SetValue	Item: [Forms]![Init. events].[Section](0).[Visible] Exp.: = No
	MoveSize	Width: 16 cm
Section(0) of Main invisible	SetValue	Item: [Forms]![Main Table].[Section](0).[Visible] Exp.: = No
	MoveSize	Width: 16 cm
Section(0) of System invisible	SetValue	Item: [Forms]![System].[Section](0).[Visible] Exp.: = No
Section(0) of System visible	SetValue	Item: [Forms]![System].[Section](0).[Visible] Exp.: = Yes
Section(0) of WTB invisible	SetValue	Item: [Forms]![WTB Table].[Section](0).[Visible] Exp.: = No
	MoveSize	Width: 12 cm
Section(0) of WTB Menu invisible	SetValue	Item: [Forms]![WTB Menu].[Section](0).[Visible] Exp.: = No
Section(0) of WTB Menu invisible	SetValue	Item: [Forms]![WTB Menu].[Section](0).[Visible] Exp.: = Yes
Sorry	MsgBox	
Text 1 on Comp Menu visible	SetValue	It: [Forms]![Comp Menu]![Field44].[Visible] Exp.: = Yes
	SetValue	It: [Forms]![Comp Menu]![Text91].[Visible] Exp.: = Yes
Text 2 on Comp Menu visible	SetValue	It: [Forms]![Comp Menu]![Comp].[Visible] Exp.: = Yes
	SetValue	It: [Forms]![Comp Menu]![Text92].[Visible] Exp.: = Yes
Text 3 on Comp Menu visible	SetValue	It: [Forms]![Comp Menu]![Field97].[Visible] Exp.: = Yes
	SetValue	It: [Forms]![Comp Menu]![Text96].[Visible] Exp.: = Yes
Top Event to Unwanted Events	Echo	Echo On: No
	Close	Form: Top Event 1
	Close	Form: Top Event 2
	Close	Form: Calculation
	OpenForm	Form: Unwanted Events
Unwanted Events to 5001	Echo	Echo On: No
	SetValue	It: [Forms]![Unwanted Events]![Field575] Exp: =5001
	Close	
	OpenForm	Form: Top Event 1
	OpenForm	Form: Top Event 2

Macro	Action	Action arguments
	OpenForm	Form: Calculations
	SetValue	It: [Forms]![Calculations]![Button18].[Visible] Exp: =No
	RunCode	Func. Name: Top_Event_5001()
•		
•		
•		
Unwanted Events to 5011	Echo	Echo On: No
	SetValue	It: [Forms]![Unwanted Events]![Field575] Exp: =5011
	Close	
	OpenForm	Form: Top Event 1
	OpenForm	Form: Top Event 2
	OpenForm	Form: Calculations
	SetValue	It: [Forms]![Calculations]![Button18].[Visible] Exp: =No
	RunCode	Func. Name: Top_Event_5011()
Unwanted Events to 5500	Echo	Echo On: No
	SetValue	It: [Forms]![Unwanted Events]![Field575] Exp: =5500
	Close	
	OpenForm	Form: Unwanted Events
	OpenForm	Form: Calculations
	SetValue	It: [Forms]![Calculations]![Button18].[Visible] Exp: =No

2.6. Modules

A module is a collection of declarations, statements, and procedures stored together as one named unit.

Modules	Explanation
Pause	Is needed to run the series of executable programs one by one intended for reliability analysis. The programs must be stored in a c:\EFP_94 directory and comprise the following files: *binput.exe, bikhk.exe, dima.exe, cutin2.bat, cut_ev.bat, bcut_imp.exe*
Top Event 5001 Top Event 5002 Top Event 5003 Top Event 5004 Top Event 5005 Top Event 5006 Top Event 5007	Modules are needed to run the set of queries for selecting the information intended to be the source of data under the forms *Top Event XXXX-1* and *Top Event XXXX-2*, where *XXXX* is Top Event number according to the Cause-Consequence diagram

Modules	Explanation
Top Event 5008 Top Event 5010 Top Event 5011	
Updat_date Updat_rate	Modules are intended to check the date of the last updating of the rates of initiating events. In case the last updating was more than 90 days ago, the system will give out the message.

3. Reference

1. The EFP-94 Project on Safety Systems for Wind Turbines. Method for Evaluation of Failure Modes and Reliability. Risø-R-915. Hans Erik Kongsø, Igor O. Kozin, Palle Christensen. Risø National Laboratory, Systems Analysis Department. September 1996.

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The database objects, which are summarised in the main report of the project are described in detail.

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